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PATENT & TRADEMARK OFFICE

TRANSMITTAL LETTER (General - Patent Pending)	Docket No. H0004811-4520

In Re Application Of: Raymond H. Thomas, Kane D. Cook and Anthony Manz

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/824,094	4/14/2004	B. Carrillo	000128	1746	6156

Title: IMPROVED FLUSHING FOR REFRIGERATION SYSTEM COMPONENTS

COMMISSIONER FOR PATENTS:

Transmitted herewith is:

Reply to Office Action dated 5/4/05.

in the above identified application.

- ☒ No additional fee is required.
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Gary Hecht

Signature

Dated: **June 6, 2005**

Gary A. Hecht, Reg. No. 36,826
Synnestvedt & Lechner LLP
2600 Aramark Tower
1101 Market Street
Philadelphia, PA 19107
Tel: 215-923-4466
Fax: 215-923-2189

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June 6, 2005 MAIL STOP AMENDMENT

(Date)

Kathy P Higgins

Signature of Person Mailing Correspondence

Kathy P. Higgins

Typed or Printed Name of Person Mailing Correspondence

cc:

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:
Raymond H. Thomas,
Kane D. Cook, and
Anthony Manz

Application No.: 10/824,094

Filed: 4/14/04

For: Improved Flushing for Refrigeration System Components

Group Art Unit: 1746

Examiner: B. Carrillo

Attorney Docket No.: H0004811-4520 (S&L P26,910A)

Confirmation No.: 6156

Customer No.: 000128

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as first class mail in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on June 6, 2005.

Kathleen P. Higgins

Kathleen P. Higgins

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

REPLY TO ACTION OF 5/4/2005

Sir:

This is in reply to the office action of 5/4/05. Enclosed with this paper is a copy of page 11-27 from Chemical Engineers' Handbook, Perry and Chilton, Fifth Edition.

A restriction requirement has been made on the basis that the inventions are distinct. The claims have been grouped as follows:

I. Claims 1-20, and 26-27 drawn to a method, and
II. Claims 21-25 drawn to an apparatus.

Applicants elect the claims of group I (Claims 1-20, 26-27), the restriction requirement being traversed for the reasons set forth below.

As provided in MPEP § 806.05 (e), a process and apparatus for its practice can be shown to be distinct inventions, if either or both of the following can be shown: (A) that the process as claimed can be practiced by another materially different apparatus or by hand; or (B) that the apparatus as claimed can be used to practice another and materially different process. The examiner is required to provide reasonable examples that recite material differences. In the present case, applicants contend that the examiner has not met its burden of showing that the inventions are distinct.

The requisite example given by the examiner in support of the restriction is that the "method as claimed can be practiced by another materially different apparatus which does not require an evaporator. For example, a heating means can be used to vaporize the solvent." (It appears that the examiner is referring to subparagraph (b) of method claim 1 which includes the element of "vaporizing"; method claim 12 does not use the term "vaporizing", but uses the term "evaporating" in subparagraph (c)). Applicants believe that this example is incorrect and does not support restriction.

It is unclear what the relevance is of the statement that a heating means can be used to vaporize the solvent. An evaporator is in fact a heating means. Included here with is a copy of page 11 – 27 from Chemical Engineers' Handbook, Perry and Chilton, Fifth Edition. As noted in the first paragraph of page 11 - 27, heat transfer is the most important single factor in evaporator design. Moreover, reviewing the section entitled Evaporator Types And Applications, it is seen that evaporators are classified based on the type of heating means. That a heating means can be used to vaporize the solvent, as noted by the examiner, is irrelevant for purposes of restriction since an evaporator is in fact a heating means to vaporize the solvent. Thus the example provided in the office action is believed to be incorrect and does meet the burden of providing a reasonable example of the material differences between the inventions. Accordingly, the claimed inventions have not been shown

to warrant restriction.

For the reasons set forth above, applicants believe that restriction is not warranted between the two groups of claims, and respectfully request that the restriction requirement be withdrawn and that all claims be examined.

Respectfully submitted,

June 6, 2005

Gary Hecht

Gary A. Hecht, Reg. No. 36,826
SYNNESTVEDT & LECHNER LLP
1101 Market Street
2600 Aramark Tower
Philadelphia, PA 19107-2950
Tele: (215) 923-4466
Fax: (215) 923-2189

GAH:dns

Chemical Engineers' Handbook

FIFTH EDITION

Prepared by a staff of specialists
under the editorial direction of

Robert H. Perry
Consultant

Cecil H. Chilton
Senior Advisor
Battelle Memorial Institute

McGRAW-HILL BOOK COMPANY

New York St. Louis San Francisco Auckland Bogotá
Düsseldorf Johannesburg London Madrid Mexico
Montreal New Delhi Panama Paris São Paulo
Singapore Sydney Tokyo Toronto

EVAPORATORS

REFERENCES: Badger and Banchero, "Introduction to Chemical Engineering," McGraw-Hill, New York, 1955. "Testing Procedure for Evaporators," American Institute of Chemical Engineers, 1961. Standiford, *Chem. Eng.*, 70, 158–176 (Dec. 9, 1963).

PRIMARY DESIGN PROBLEMS

Heat transfer is the most important single factor in evaporator design, since the heating surface represents the largest part of evaporator cost. Other things being equal, the type of evaporator selected is the one having the highest heat-transfer "coefficient" under desired operating conditions in terms of B.t.u. per hour per degree Fahrenheit per dollar of installed cost. When power is required to induce circulation past the heating surface, the "coefficient" must be even higher to offset the cost of power for circulation.

Vapor-liquid separation may be important for a number of reasons. Most important is usually prevention of entrainment because of value of product lost, pollution, contamination of the condensed vapor, or fouling or corrosion of the surfaces on which the vapor is condensed. Vapor-liquid separation in the vapor head may also be important when spray forms deposits on the walls, when vortices increase head requirements of circulating pumps, and when short circuiting allows vapor or unflashed liquid to be carried back to the circulating pump and heating element.

Evaporator performance is rated on the basis of **steam economy**—pounds of solvent evaporated per pound of steam used. Heat is required (1) to raise the feed from its initial temperature to the boiling temperature, (2) to provide the minimum thermodynamic energy to separate liquid solvent from the feed, and (3) to vaporize the solvent. The first of these can be changed appreciably by reducing the boiling temperature or by heat interchange between the feed and the residual product and/or condensate. The greatest increase in steam economy is achieved by reusing the vaporized solvent. This is done in a **multiple-effect evaporator** by using the vapor from one effect as the heating medium for another effect in which boiling takes place at a lower temperature and pressure. Another method of increasing the utilization of energy is to employ a **thermocompression** evaporator, in which the vapor is compressed so that it will condense at a temperature high enough to permit its use as the heating medium in the same evaporator.

Selection Problems. Aside from heat-transfer considerations, the selection of type of evaporator best suited for a particular service is governed by the characteristics of the feed and product. Points that must be considered are crystallization, salting and scaling, product quality, corrosion, and foaming. In the case of a crystallizing evaporator, the desirability of producing crystals of a definite uniform size usually limits the choice to evaporators having a positive means of circulation. **Salting**, which is the growth on body and heating-surface walls of a material having a solubility that increases with increase in temperature, is frequently encountered in crystallizing evaporators. It can be reduced or eliminated by keeping the evaporating liquid in close or frequent contact with a large surface area of crystallized solid. **Scaling** is the deposition and growth on body walls, and especially on heating surfaces, of a material undergoing an irreversible chemical reaction in the evaporator or having a solubility that decreases with an increase in temperature. Scaling can be reduced or eliminated in the same general manner as salting. Both salting and scaling liquids are usually best handled in evaporators that do not depend on boiling to induce circulation. **Fouling** is the formation of deposits other than salt or scale and may be due to corrosion, solid matter entering with the feed, or deposits formed by the condensing vapor.

Product quality considerations may require low hold-up time and low-temperature operation to avoid thermal degradation. The low hold-up time eliminates some types of evaporators, and some types are also eliminated because of poor heat-transfer characteristics at low temperature. Product quality may also dictate special materials of construction to avoid metallic contamination or a catalytic effect on decomposition of the product. **Corrosion** may also influence evaporator selection, since the advantages of evaporators having high heat-transfer coefficients are more apparent when expensive materials of construction are indicated. Corrosion and erosion are frequently more severe in evaporators than in other types of equipment because of the high liquid and vapor velocities used, the frequent presence of solids in suspension, and the necessary concentration differences.

EVAPORATOR TYPES AND APPLICATIONS

Evaporators may be classified as follows:

1. Heating medium separated from evaporating liquid by tubular heating surfaces.
2. Heating medium confined by coils, jackets, double walls, flat plates, etc.
3. Heating medium brought into direct contact with evaporating liquid.
4. Heating by solar radiation.

By far the largest number of industrial evaporators employ tubular heating surfaces. Circulation of liquid past the heating surface may be induced by boiling or by mechanical means. In the latter case, boiling may or may not occur at the heating surface.

Forced-circulation Evaporators (Fig. 11-16*a*, *b*, *c*). Although it may not be the most economical for many uses, the forced-circulation (F.C.) evaporator is suitable for the widest variety of evaporator applications. The use of a pump to ensure circulation past the heating surface makes possible separating the functions of heat transfer, vapor-liquid separation, and crystallization. The pump withdraws liquor from the flash chamber and forces it through the heating element back to the flash chamber. Circulation is maintained regardless of the evaporation rate; so this type of evaporator is well suited to **crystallizing operation** where solids must be maintained in suspension at all times. The liquid velocity past the heating surface is limited only by the pumping power needed or available and by accelerated corrosion and erosion at the higher velocities. **Tube velocities** normally range from a minimum of about 4 ft./sec. in salt evaporators with copper or brass tubes and liquid containing 5 per cent or more solids, up to about 10 ft./sec. in caustic evaporators having nickel tubes and liquid containing only a small amount of solids. Even higher velocities can be used when corrosion is not accelerated by erosion.

Highest heat-transfer coefficients are obtained in F.C. evaporators when the liquid is allowed to boil in the tubes, as in the type shown in Fig. 11-16*a*. The heating element projects into the vapor head and the liquid level is maintained near and usually slightly below the top tube sheet. This type of F.C. evaporator is not well suited to salting solutions because boiling in the tubes increases the chances of salt deposit on the walls, and the sudden flashing at the tube exits promotes excessive nucleation and production of fine crystals. Consequently, this type of evaporator is seldom used except where there are headroom limitations or when the liquid forms neither salt nor scale.

By far the largest number of forced-circulation evaporators are of the submerged-tube type, as shown in Fig. 11-16*b*. The heating element is placed far enough below the liquid level or return line to the flash chamber to prevent boiling in the tubes. Preferably, the hydrostatic head should be sufficient to prevent boiling even in a tube that is plugged (and hence at steam temperature), since this prevents salting of the entire tube. Evaporators of this type sometimes have horizontal heating elements (usually two-pass), but the vertical single-pass heating element is used wherever sufficient headroom is available. The vertical element usually has a lower friction loss and is easier to clean or retube than a horizontal heater. The submerged-tube forced-circulation evaporator is relatively immune to salting in the tubes, since no supersaturation is generated by evaporation in the tubes. The tendency toward scale formation is also reduced, since supersaturation in the heating